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District Office Files

EIGHTH

ANNUAL REPORT

INTERMOUNTAIN STATION
Central Reference File
No. 0.73

PRIEST RIVER FOREST EXPERIMENT STATION

1918

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Original
District Forester's files

Annual Report Priest River Experiment Station

Season 1918

Personnel

The men employed at the Experiment Station during the year are: Forest Examiner J. A. Larsen, Forest Assistant P.C. Kitchin from October until April; Ranger W.P. Hillman up to April; Ranger Arthur Pauley from July to September and Ranger Gerhard Kempff as Field Assistant from August till November, later succeeding Pauley as Ranger.

Up to and including part of August, the entire time of the investigative men was used finishing report on past work. There is now no more old work to be cleaned up except the report on climate in relation to fire hazard. Reports completed during the year are as follows: Climate in Relation to Forest Types, Factors affecting Natural Reproduction, Methods of Stimulating White Pine Germination, Experimental Introduction of Hardwood Species, Characteristics of Some Coniferous Seeds Native to District One, Reports on experimental introduction with non-native conifers and complete progress report on the studies in Comparative Germination of Seed in Nursery and Greenhouse.

In early August the field work begun on the Management studies and was alternated with office work in preparation of plans and memoranda of work done, seed testing, etc.

Copy sent Forester
Exp. Stn
Routed Districts
" Forests

Improvements and Maintenance

This line of work has been reduced to the very minimum so that no noticeable forward step can be recorded, due mainly to the low ebb of the financial condition during the war and to some extent the changes in personnel. A few of the things worth mentioning are: New coat of paint on the greenhouse, papering of the offices, new herbarium cases and glass cabinets for glassware and chemicals, retouching of interior trimmings cottages 1 and 2.

Forestation Studies

New installations in planting or nursery studies of native species have been discontinued and as previously stated, entirely taken over by the Office of Planting and continued at Savenac and Wallace. All of the experiments previously conducted at the Station were reported on in full 1917. There remains certain plots in classes of stock and root pruning at Priest River which are measured and observed annually.

The only new planting of any kind at the Station is with non-native species, some plots of which were installed near the nursery on Benton Flat, spring 1918. All of the previous plantations were covered by separate reports by species, winter 1918. They include Siberian, European and Japanese larches, Norway and Sitka spruce, Incense cedar, Big tree, Norway, loblolly, Jeffrey, Scotch Austrian Sugar and Eastern white pine. These have on the whole not been given sufficient trial in that they were not planted on more than one or two sites, a larch and Douglas fir sandy bench and a cut-over white pine

bench. Considerable promise, however, is shown by Norway spruce, Norway pine, European and Siberian larch. By far the best growth has been attained by eastern white pine, but its lanky scrawny form and rapid growth makes it less able to resist damage by snow in this region. Scotch pine and European larch seem to do best on the larch-fir bench, the larch, however, suffers slight injury by frost. The Norway spruce, Norway pine and Eastern white pine prefer the white pine bench. Austrian pine, planted on the larch-fir bench has made remarkably little growth during the last five years.

Several odd lots of miscellaneous conifers which had been carried in the transplant beds were set out last spring near the nursery, away in a place where they could be given better care and attention, even artificial watering if necessary to carry them over the first tender years.

Hardwood Plantations

A report was prepared covering the experiments in hardwood introduction by the Station from 1911 to 1916. These were tested out on the cut-over white pine bench and planted from two to four years after logging. They have been listed in last year's report.

In working up this report, comparison was made of temperatures, precipitation and frostless season of northern Idaho and typical hardwood regions in Michigan and Illinois. On the basis of this it was concluded that the northern Idaho climate is entirely unsuited for hardwoods. The precipitation in summer is by far too low, the summer nights too cold and the

growing season too short. The trees suffer most by early and late frost injury to stem and leaves.

A few trees can very likely be nursed along to larger size provided they are given extra good care which means watering in summer, protection from cattle, weeds, rodent and other injuries, but their growth will at best be very slow and they will suffer more or less frost injury each year. These are: ulmus americana, fraxinus americana, prunus serotina, acer saccharinum, quercus rubra, corylus americana, acer negundo, Betyla alba, ulmus pumila and with watering and care a greater variety can be grown within the yellow pine type of forest, as shown by the shade trees in Spokane and Coeur d'Alene.

Seed Studies

Current work in seed studies at the Station includes observations and measurements on twenty plots of western yellow pine from different sources, greenhouse tests in comparative germination studies. Two plots of western yellow pine seed from Sioux Forest included, selected from straight grained and corkscrew bole trees were sowed in the nursery for later field tests.

Two seed study reports were finished this year, "Methods of Stimulating White Pine Germination" and "Some Characteristics of Coniferous Seeds." The first was the result of several years' study, aiming to find a method for hastening germination. The means recommended are: (1) Immersion in concentrated sulphuric acid, 45 minutes with thorough rinsing. Highest germination 38.5%,

check test 4% to 5%. (2) Reduction of seed coat by mechanical abrasion or penaling in such a manner that the seed kernel is not crushed or injured in a churn coated with emery dust. Germination by this method, 16.5% in forty days in greenhouse. That this method when perfected will be more satisfactory is shown by 51% and 56% nursery germination obtained by cutting a small hole in the root end of seed coat. (3) Soaking the seed in cold water for 24 hours and exposing it to air freezing in winter for forty days, gave 17.5% germination in greenhouse with 5.5% for the check test. (4) Stirring the seed daily in warm moist bark-free sawdust gave a greenhouse test of 53% in 100 days, compared with 29.5% in the check test. Many other methods were tried, but these give most promise.

By collecting seed from one and the same tree at 15-day intervals during period of ripening 1917, a more rapid germination was obtained from that collected earlier and uniformly higher, but slower total tests from the seed of later collection. This fact and an examination of the seed coat lead to the belief that the impermeability of the seed coat, which has been considered the main obstacle to germination by previous tests is less of hindrance in immature seed and that a greater number obtain ripening with the progress of the fall.

The second report in seed studies presents some characteristics of coniferous seeds native to District One, as brought out by six years of greenhouse tests. The characters set forth are: rate and progress of germination, suitable temperatures and methods, longevity or deterioration under storage,

number of seed per pound and variation from different regions. Samples of seed are reserved for later ageing tests.

A complete progress report was also prepared, setting forth the results in comparative germination studies with western yellow pine, western white pine, western larch, Douglas fir and Engelmann spruce. The ratios of nursery to greenhouse center around 100% for yellow pine, 103, 116 and 129% for Douglas fir at Priest River, Savenac and Boulder respectively. The amount of work with larch and spruce is yet insufficient to establish a satisfactory ratio and the erratic behavior of western white pine seed has prevented satisfactory results. The future nursery tests will be conducted at Savenac.

Management Studies

Our active management studies embrace methods of cutting (Me-1) with sub-projects on girdling, seed storage, longevity and brush disposal, Natural Reproduction (Mr-1), Thinnings (Mt-1) and Volume, Growth and Yield Studies (Me-).

The field work begun by Mr. Brewster could not be continued because of his absence. No work has been done on thinnings or volume and yield studies. A report was submitted covering the studies conducted at the Station in Natural Reproduction since 1913. This report sets forth the physical differences on the northeast and southwest slopes and on the flat where the seed was sown, and the differences in germination, survival and growth of the native coniferous species.

Observations on soil moisture and temperature have

been made at different depths, but limited space makes it necessary to confine summaries to 12" depths.

In the germination of western white pine, the kind of surface and amount of light matters little; the essential thing is sufficient moisture and suitable temperatures. Light, however, as well as soil moisture, become important factors in survival and growth. Though the germination may take place on these several aspects, kinds of surfaces, and degrees of shade, the seedlings need protection on the exposed southerly slopes and flats. The required conditions for establishment and growth are mean seasonal soil temperature from 50° to 60° F., soil moisture not below the minimum of 18% and at least 40% of light.

Good germination of western yellow pine may be obtained on grassy, burned and denuded surfaces on the several aspects and conditions of shade, provided there is sufficient soil moisture and heat. It is better on burned and denuded surfaces except on the exposed sites, but survival and growth can only be expected with certainty on the warmer exposed flats and southerly aspects. When once established here it makes decidedly better growth on the burned and denuded surfaces than in the presence of vegetation. Successful establishment and growth requires a mean seasonal soil temperature between 60° and 70° from May to September inclusive; from 75% to 100% of light; and a mean soil moisture between 15% and 20%, though the minimum may drop as low as 3% in August.

Douglas fir germination like the white and yellow pine, also takes place on all aspects and is more dependent upon soil

moisture than light or the character of surface, though somewhat better on the denuded or burned surfaces. Survival and growth is poor, however, under dense shade and on the exposed sites especially unprotected southerly aspects. Successful establishment requires at least 45% of light; a mean soil moisture from 18% to 20%, which may go down to 5% in August; and a mean soil temperature between 58° and 70°. Such conditions are found on the open northerly aspects and flats and under the protection of brush on the more open southerly gradients.

Western larch germination is also independent of light and on northerly slopes and flats succeeds better on burned and denuded surfaces than in the presence of vegetation. The seedlings survive equally well whether the surface be burned, denuded or covered with light vegetation, but a new stand cannot be expected except with full overhead light and on sites with good or medium soil moisture conditions, where the minimum does not go below 5% or 6% during the driest part of the summer. These conditions are found chiefly on the flats and northerly slopes. Much larch germination may take place the second season after the seed is shed.

The seed of western hemlock germinated better in the shade than in the open and decidedly better on the northeast slope than elsewhere, chiefly because moisture conditions are more favorable; but survival was negligible except in the open site on the northeast aspect. Establishment of this species requires soil moisture not below 20 per cent and from 30 to 50

per cent of the available light. These conditions are met on better soil in the breaks in the virgin timber on flats and northerly slopes. Greater death by fungi occurred on bared surfaces and better growth occurred in the presence of vegetation than on the burned and denuded surfaces. In these respects it differs from all other species except white fir, and it is possible that this is another evidence of its preference for organic material, which results in so much reproduction in decaying wood. That further tests with this and other species in different kinds of soil under uniform air and moisture conditions are needed is clearly indicated.

Western red cedar has practically the same soil moisture and temperature requirements as the hemlock and successful reproduction can be depended on only on the better soiled flats and northerly aspects. Unlike hemlock it made noticeably better growth on the burned and denuded surfaces than among vegetation.

White fir germinated better on the northeast aspect than elsewhere and poorest on the southwest slope. Survival was found only on the northeast slope and better growth among vegetation.than on bared surfaces. The moisture requirements of this species are very similar to those of the cedar and hemlock, but it needs more light and heat.

Methods of Cutting

With the completion of reports on past work, studies were begun aiming to get more definite information on the amount and viability of seed in the duff. The best method of brush

disposal to preserve and utilize the seed, the amount of reproduction which actually results from stored seed, and the source of seed on extensive fresh burns and the nature of the change which takes place in site subsequent to logging and its effect upon the establishment.

A supplementary working plan was prepared and approved by the District Forester and field work begun in August by laying our plots for different methods of brush disposal--time and manner of burning in recently cut timber, installation of two five-acre plots on the Bryant Creek sale on one of which no seed trees will be left and another cut according to marking rules. Several stands were sampled for seed in the duff and sifted and six beds were sowed under timber in different locations to test the longevity of the seed in duff on the forest floor. This work has been covered by separate memoranda, and it is too early to expect results. Considerable light is thrown on the amount of seed in the duff previous to logging by the following data from the Bryant Creek sale, west branch:

Thirteen samples of duff each two square feet at intervals of 50 feet were taken on two five-acre plots, the seed sifted and counted. By figuring the amount of seed per acre from this sampling, the following figures were obtained. (All of the cedar seed was not counted but the number obtained by the relation to white pine seed.)

Species	Estimate per acre
White pine	192,635
Douglas fir	5,027
Larch	88,807
Hemlock	5,027
Cedar	1, 892,000
White fir	62,842
Spruce	1,676

The stand contains chiefly white pine, larch and cedar. The quality of this seed is now being tested in the greenhouse.

Considerable work was done in girdling hemlock and white fir in a 250-year-old stand in 1916 and 1917. Regular observations were made during these years on death of the trees, seed production, etc. Aside from testing the seed no work has been done on this study in 1918. To eliminate weed trees satisfactorily, they must be killed outright, either by felling or burning, for otherwise they produce seed even the second year after girdling.

Type Study

A report was also prepared covering five years' daily records and observations on climatic and soil conditions on four different sites and timber growth near the Experiment Station. This was combined with a study of the climates prevailing within the broader regional forest belts in District One. The local study brings to light characteristic differences in soil and climate caused by aspect, composition of soil, etc., and furnishes a basis for a better conception of the site requirements of the species

for management and for future studies. The regional study in a large measure explains the present tree distribution and sets forth normal climatic conditions of value both in fire protection and silvicultural studies.

Summary, Part I, Regional climatic study of forest types.

1. The western yellow pine type occurs in three separate areas:-northern Idaho-eastern Washington; Flathead and Bitter Root valleys, and in eastern Montana. It forms the lower part of the forested regions and extends farthest out on the prairie because this species requires less precipitation and more heat than any other in the District. The necessary climatic condition is a mean annual temperature from 43 to 50 degrees F., an average mean summer temperature from 59 to 65 degrees with at least 185 days having a mean above 43 degrees, and a precipitation of not less than 15 inches annually.

2. The region of greatest precipitation in the District is on the westerly slopes of the Bitter Root Mountains, which supports a hydrophytic association of trees composed of white pine and other moisture-loving species whose climatic requirements are: a mean annual temperature between 40 and 49 degrees, an average summer mean from 53 to 60 degrees, a precipitation of not less than 27 inches a year, and not less than 2 inches during July and August.

3. Extensive forests of larch and Douglas fir appear in the northern part of the District in Flathead and

Kootenai watersheds in which the larch is the key species, and this requires an annual mean temperature of from 41 to 45 degrees, an average summer mean from 53 to 58 degrees and a precipitation of not less than 17 inches a year and 7 inches in summer. The larch does not extend southward into the Bitter Root valley, because suitable precipitation is not found coincident with the required temperatures and it avoids the eastern slopes of the Rocky Mountains largely because the elevations are too high and the temperatures too low both summer and winter. It does not extend out toward the prairies as far as the yellow pine and Douglas fir through lack of precipitation.

4. The lodgepole pine and Douglas fir forests of the mountainous region east of the main divides in Montana, and south of the range of white pine and larch thrive under a colder climate and with less precipitation than other trees in the District except yellow pine. Lodgepole pine tolerates a colder climate than the fir, but the fir may survive with less moisture. The climatic records in this kind of forest show a mean annual temperature of 38 degrees, a summer mean of 54.3 degrees, a precipitation of 23 inches with above 7 inches in summer. The minimum amount of downpour for lodgepole pine forests is 18 inches.

5. It appears that the prairies in northern Idaho and Washington, Flathead and Bitter Root Valleys, and eastern Montana are treeless because the soil is sometimes alkaline and poorly drained, and rainfall insufficient The prairies of northeastern and northern Montana do not support tree growth because of too little precipitation which is barely sufficient for yellow pine and temperature

too low. The air temperatures are suitable for fir and lodgepole pine, but there is not sufficient precipitation.

6. Northward and altitudinal extension of the species is limited by too low temperatures and the southward and downward extension prevented by lack of moisture which is more of a limiting factor in summer than in winter.

Summary Part II

The results of the study of climate and site characteristics on the different slopes and aspects near the Experiment Station in Northern Idaho and how these influence the forest distribution may be summarized in the following:

1. The mean annual and the mean summer temperature as well as the length of the growing season found in the forest types on the different aspects at the Experiment Station in Northern Idaho come within the limits of the climatic requirements of these as determined by the regional type study.

2. The mean annual and the mean summer temperatures are 2.4° higher on the southwest yellow pine slope than on the larch-fir flat, and 1.7° higher than on the northeast white pine slope. The maximum temperatures are highest for the southwest slope and lowest for the northeast, but the minima are lowest on the flat and highest on the northeast slope. The range in temperature and the danger from frost are, therefore, greatest on the flat and least on the northeast aspect. The growing season is 15 days longer on the southwest slope than on the other two sites.

3. Soil temperatures follow air temperature in the main and show as much divergence according to aspect as the air. The differences are greatest in August and least in January and February and greater for the surface soil than at lower depths. The temperature of the soil varies inversely as the moisture content and this last is also influenced by the amount of fine material. The white pine soils have a high percentage of fine material and water content, but a lower and less fluctuating temperature than yellow pine or Douglas fir soils.

4. Wind movement does not influence the character of the site except on slopes. The records show this to be twice as great on the southwest slope as on the flat and only one quarter as much on the northeast aspect as on the southwest. Since the wind strikes the sunny aspects in this region constantly and with the greatest force when the humidity is lowest and the temperature highest, it becomes an important fact of site.

5. Atmospheric humidity is much lower on the southwest yellow pine slope than on the northeast in summer, but there is, on the whole, little difference between the flat and the southwest slope. The lowest average August himidities on record are 26.2% on the flat, 23.6 on the southwest, and 33.0 on the northeast slope. It is not considered a factor of site except during July and August or first part of September when the minima increase the drought on the exposed slopes.

6. Aspect and degree of slope are influential in causing greater snowfall and later melting of the snow layer on north

and east gradients; this retards a rise in soil temperature in spring and shortens the growing season.

7. Evaporation is greatestoon the southwest yellow pine slope and least on the northeast white pine site. In terms of heat energy per day during August, 1917, by the amount of water evaporated, it was 145 calories on the southwest slope, 123 calories on the flat, and 119 calories on the northeast slope.

8. The moisture content of the soil on the southwest slope is lower and of longer lower duration than on the northeast slope, but there is not much difference between the yellow pine slope and the sandy flat. The white pine clay-like soil supporting larch and Douglas fir, ~~and~~ is more similar in this respect to the soil water content of the northeast aspect. In testing two different kinds of soil on the same site, it was found that 50% of the difference between the moisture of the soil on the flat and the northeast slope was due to the character of the soil itself and 50% due to the protection offered by aspect. The latter, is, therefore, a factor of site as well as the nature of the soil.

9. A microscopic examination of leaf sections for evidence of modification in structure according to site requirements showed that the leaves of xerophytic and heliophile species are better able to transport water and to resist transpiration than the tolerant trees, by involuted parenchyma, more intercellular spaces, increased collenchyma and parenchyma tissue, a lignified as well as a heavier epidermis, and by sunken stomata, and that

less pronounced development of these structural features enables the more tolerant trees to utilize light more completely than the intolerant.

10. The amount of precipitation is sufficient on all aspects for white pine, but the character of the vegetation and degree of slope, through the operation of the climatic factors, cause a more rapid drainage and drying out on the exposed aspects so that there is deficient moisture in the ground during the critical part of the summer on exposed slopes for the moisture loving species. Under suitable air temperatures the amount of soil moisture in a given soil in July and August is the best site indicator.

11. The air temperature on the north aspects and on flats and benches near the Experiment Station is too low for yellow pine, but does not become a limiting factor for any other species on any site in this region. Temperatures on the southerly aspects are near the minima required for the yellow pine and this explains why this species is near the northern limit of its distribution.

12. The amount of light on the north aspects is deficient for yellow pine and is more suitable for white pine, Douglas fir and larch. Light conditions on the exposed slopes are not too severe for the last species, but cedar and hemlock require protection from direct sunlight both here and on flats before reaching maturity.

Fire Studies (Pf-2)

No field work has been done on this project 1918. The

data gathered 1916 and 1917 has been worked up and will be combined with some of the District climatic data gathered under T-1 for a report to be gotten out this spring.

An effort was made to establish several fairly complete and permanent pivotal Forest Service weather stations within typical forested regions in Idaho and western Montana which will enable us to keep record of the climatic conditions from month to month and year to year for use in fire protection as well as silviculture and management. Difficulty has been met in this respect, for such stations should be yearlong, in suitable locations, and taken care of by men who appreciate the problems and take interest in the work.

Considerable progress has been made toward classification of the Experiment Station Library in that the titles, authors, contents of all books, pamphlets and miscellaneous reports and abstracts have been listed. Most of these are not entered on index card. This work remains to be done as well as the cataloging.

All herbarium speciments have been mounted in duplicate and triplicate and places in genus folders. The work of labeling remains to be done.

The Station was fortunate in securing a fairly complete set of permanently mounted slides showing leaf and wood structure of our native species. These were needed in connection with the type study and will be a permanent asset of great value.

PLANS FOR FUTURE WORK

(See resume last page)

Because we are now at a point when the character of the work undertaken in the immediate future will largely determine the course of many of our studies during the next five years, it has been thought best to devote more than usual space to a discussion of the nature and need for such studies.

Except for the plots in root pruning and classes of stock mentioned in the foregoing no planting and nursery work will remain on the Station program, but whatever falls under seed studies will be handled.

Work could be undertaken to advantage on source of seed, western white pine embracing quality and characteristics, rate of growth and vigor of stock from trees of variable elevations, size and health and kinds of cones, etc. An effort will be made to prepare a working plan next winter. This will possibly include other species also.

Seed production of white pine and other species is another project on which we should begin to think more seriously. There is considerable information current on seed years and localities of production which should be gathered currently on suitable cards. More intensive studies must be outlined by a plan still pending.

It is felt that the testing of non-native conifers should be continued at the Experiment Station as well as at Savenac, Wallace or elsewhere. There are several reasons for

this: Ideal forest conditions, opportunities for tryout on different aspects not heavily denuded, underplanting, tests on newly cut areas and good chances of constant attention and study. It is therefore recommended that a working plan be prepared at first opportunity which aims at a selection of conifers from different parts of the world where the climate is not too radically different from our own and for planting on different sites.

Management Studies

The management studies which have been launched on the Kaniksu and at the Experiment Station should be enlarged and intensified--enlarging by duplication and experiments covering similar and other methods on larger plots especially those aiming to test different methods of brush disposal and amount of reproduction from duff or seed trees; intensified by culture tests both in greenhouse and field of seedlings in different soils and soil solutions, whether acidic alkaline and water and light requirements of seedlings under closely controlled conditions both in field and greenhouse. These studies can in a measure be combined with the type study to help solve problems of actual temperatures, etc. needed for the life functions. The preparation of such a working plan will require considerable reading and thought, and should receive consideration during the coming year.

These intensive studies can best be undertaken in the vicinity of the Experiment Station, but the biological or chemical tests which need special equipment and training can best be conducted at a laboratory.

Thinnings

The four plots established 1914 in the 60-year larch and white pine should, according to the plan, be remeasured 1919. In order to show differences in growth the original data taken 1914 must be worked up and hammered into shape so that comparisons are possible. This involves volume tables and tabulations.

Though this is an expensive and long-time project, we should not delay installations much longer. It is proposed to begin a new series 1919 by thinning and possibly pruning in a younger 30-40 year stand.

As previously pointed out, growth and yield studies on the Kaniksu will serve only the white pine region. There are already three experimental tracts in the District where such studies have been begun, Kaniksu, Deerlodge, and Sioux forests. These serve white pine, lodgepole pine and eastern yellow pine. The writer would like to see at least two more experimental units selected, one in larch-fir timber on the Blackfeet and another in yellow pine on the Missoula or Bitterroot. We would thus cover all of the principal regions. A typical accessible section or two of young timber with good chances of protection could be set aside for growth studies, cleanings, thinnings, prunings, etc. These must evidently be begun soon so that the information may be at hand when needed. A separate memorandum has been prepared in order to open the way for these projects.

Natural Reproduction

Perhaps the most important line of work under Management

Studies is that of natural reproduction. We may go ahead and solve problems of artificial reproduction but after all in the large majority of cases, regeneration must be accomplished by natural reseeding. Will not all problems in reestablishment simmer down to this? Wherever, from the standpoint of the soil and site alone, artificial regeneration succeeds, can we not also count on the natural from seed, provided the seed or seed trees are present? And vice versa? The advantage obtained by the artificial process is then a speedier and more even and uniform restocking. If new species are introduced or seed trees are insufficient the argument is, of course, entirely in favor of the artificial method.

The problem of natural reproduction will therefore continue to receive close attention, as a part of tree studies and closely allied to the management studies. Later when men and money are available, our efforts would be well spent in outlining and pursuing more comprehensive studies on what has actually taken place in typical regions throughout the District.

Fire Studies

Though more detailed information on the effect of soil and humus moisture, wind, humidity, etc. is necessary before we get to the bottom of this complicated problem, such studies cannot be undertaken the coming year without an extra field assistant. The chief attention must be given to management studies; moreover, the moisture and inflammability tests should be supplemented by laboratory tests on the influence of

separate factors of wind, humidity, etc. Justice can only be done to the work by detailing one man to the problem for an entire year.

The work immediately ahead for the Station in this line is the preparation of the report already mentioned. When this has been done, we may learn much of help toward future studies.

Type Studies

Under this head there are several courses or lines of work open.

1. More complete data on the influence of the forest by comparing climatic conditions within a natural forest and in a natural opening of sufficient size.

2. Variations in climate and site conditions with elevations and responses in forest cover.

3. A more intensive ecological study which aims at the correlation of all site factors with establishment and healthy development of the trees and which strikes at the physiologic reasons for their occurrence, supplemented by physiological laboratory tests.

The first and second can, in a manner, be handled near the Experiment Station, but results would have more weight if the nature of the study determined the choice of location rather than adapting it to the present location.

The third study would dovetail with proposed more intensive management problems, but it is a question whether we are sufficiently advanced to undertake it at present. However,

it is recommended that the last be given first attention with a view to the formulation of a plan for beginning 1920 or later.

Development of the Experimental Forest

Work on this project is left for the Ranger attached to the Experiment Station. As stated in previous reports, it was planned to assemble all of the reconnaissance and the growth and yield data gathered in the vicinity, prepare a descriptive report setting forth what is known regarding this tract, its timber and possibilities. No progress has been made, 1918, owing to the conditions brough about by the war and the changes in personnel.

Improvement and Maintenance

One of the most urgent projects to be considered during the coming year is the improvement plan for the Station grounds. A small scale general map was prepared, but a larger and more detailed map, scale 1 inch to 20 feet, with closer contour intervals, is needed before this important work can be adequately planned. The work of improvement will include stumping remainder of clearing, projecting and grading permanent roads and trails, permanent culverts and bridges or fills, plowing, harrowing and sowing the lawn, planting of evergreen conifers and shrubs, erection of flagpole, signs and other accessories needed to conform to the necessary standard and desired appearance. Mr. Kempff has begun such a map.

The trail leading from the Experiment Station over

the saddle to the Fox Creek watershed should be completed 1919 in order to afford ready access for experimental work in connection with the proposed timber sales on this watershed. About one-half mile of trail remains to be cut and a total of one mile to be graded.

The conditions of the fences need consideration. Each year more and more stock range on the cut-over areas where feed is abundant. The NW¼ of Section 34 where a great many plantations have been established has suffered much injury. It is therefore very necessary to strengthen the present fence and to extend it north to Benton Creek so as to protect the Natural reproduction studies there. About one-half mile of new fence is needed here and one-fourth mile around the Station clearing. Mr. Kempff will submit estimates on cost.

Considerable difficulty was experienced in keeping the water system from freezing during fall of 1918, because the creek had washed away fill from the pipe and because some sections had not been properly covered in the beginning. About fifty dollars maintenance money will therefore be needed on the water system.

ESTIMATES FOR 1919

(Silvical Investigations, Experiment Station)°

Salary, Forest Examiner, J. A. Larsen	$1400.00
Field Assistant, 6 months at $75.00	450.00
Office Assistant on Library, Herbarium, etc.	100.00
Travel, Larsen and Assistant	350.00
Supplies and Equipment	100;00
Miscellaneous freight, hauling, repairs, etc.	100.00
Total	$ 2500.00

°Estimates for salary of ranger, improvements and maintenance, horse feed, etc. are submitted by the Supervisor

J. A. Larsen
Forest Examiner

Approved: February 3 ,1919

John F. Preston
Assistant District Forester

SUMMARY OF WORK PROPOSED 1919-20

Priest River Experiment Station

Silvicultural Handbook (compilation) District One

Report on Climate and Fire Hazard District One

Working Plan for Further tests with Exotic Conifers

Working Plan for "Source of Seed" Studies

Field work on Management Studies

Working Plans for more intensive management

Studies e.g. source of seed on burns
Changes in quality of site after cutting
Brush disposal, etc.

Remeasurement of Thinning Plots and working up data into a Progress Report

Report on the Experimental Forest (Kempff)

Station Improvement Plan (Kempff)

Preliminary working plan for Type Studies

Current work--Weather observations, Seed Testing records on plantations, library and herbarium

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Author.

Title. Annual report Priest River Forest Experiment Station; 1918.

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